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## FINAL REPORT

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### Fabrication of Ten Utility Acoustic Modems, Version 2.0

<http://dogma.who.edu/matt/uModemUsersGuide.pdf>

<http://ragged.who.edu/umodem/>

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#### ABSTRACT

The purpose of this project was to build and test ten Utility Acoustic Modems and place them in the Modem Pool at WHOI so that they would be available to oceanographic researchers. Software supporting the ONR sponsored interoperability standard for acoustic communication was to be installed on the modems and augmented with higher rate and specialized communications functions as they are proven in the field. It was decided by the participants and approved by ONR to redirect the funds for the Utility Modems to a build of 16 of the newer and less complex Acoustic Micro-Modems. As a result of this decision, a total of 16 Micro-modems have been built and delivered to the Modem Pool. These units have been employed on a number of experiments and have operated very reliably.

#### RESULTS

The Micro-modem was designed at WHOI as a low cost alternative to the Utility Acoustic Modem that retained much of the functionality of its predecessor with a less costly and complex design, a simpler user interface and much lower power consumption during reception and detection. The new design is a two-board set that is 2 inches by 8 inches long. It operates at 200mW while receiving and decoding data and is designed to support a low-power detection mode that will allow the modem to receive on demand. This low power wake up has not been fully implemented to date. It uses the existing power amplifier and can drive transducers over a wide range of frequencies with the appropriate matching inductors. Software to implement acoustic communications using the Interoperability Standard defined by [1] has been installed on the modem and is being used to transmit low-rate data on several operational programs [2], [3] and [4]. In addition to building and testing the 16 Micro-Modems, pressure housings and transducers were built or purchased for 8 of the units. During the funding period micro-modems have been used on the projects listed below, though all were not necessarily part of this build.

##### Micro-modem Applications

1. Portable Coastal Observatory in Massachusetts Bay- WHOI and USGS, funded by NOPP [2].

2. Real Time ADCP data from the Gulf of Mexico- WHOI and NAVOCEANO, funded by NAVOCEANO through ONR [3].
3. ULTRAMOOR- long-term current meter mooring- WHOI, funded by NSF [4].
4. SALP- Submerged Autonomous Launch Platform for Drifters- WHOI, funded by NSF [5].
5. Odyssey class AUV installation for use on the GOATS program- MIT (Henrik Schmidt PI). (<http://acoustics.mit.edu/GOATS/index.html>)
6. Seabed AUV installation- Funded by NSF - WHOI (Hanamut Singh, PI). (<http://dsl.who.edu/DSL/hanu/seabed/index.html>)

## CONCLUSIONS

The new modem hardware has been produced and it appears to be functioning as designed. The micro-modems have been deployed on several long-term projects and they are very reliable. As more advanced software is installed that supports higher data rates, the modems will become even more useful. We are discussing a technology transfer to several current meter vendors to integrate the modems into these instruments to lower the barriers to using them on oceanographic moorings.

## PUBLICATIONS

1. Frye, D., B. Butman, M. Johnson, A. Maffei and S. Lerner, "Portable coastal observatories," *Oceanography*, Vol. 13, No. 2, 2000, pp. 24-31.
2. Ware, J., D. Frye, N. Hogg, P. Koski, B. Butman and M. Martini, "Acoustically linked ocean observatories," presented at the *Ocean Sciences Meeting*, Honolulu, Feb. 11-15, 2002.

## REFERENCES

- [1] <ftp://ael.who.edu/pub/fhfsk.pdf>
- [2] Frye, D., B. Butman, M. Johnson, A. Maffei and S. Lerner, "Portable coastal observatories," *Oceanography*, Vol. 13, No. 2, 2000, pp. 24-31.
- [3] <http://128.160.23.41/>
- [4] <http://www.who.edu/science/AOPE/ael/ultramoor/>
- [5] Fratantoni, D., D. Frye and J. Valdes, SALP: A Submerged Autonomous Launch Platform for Drifting Instrumentation, Research proposal submitted to the NSF by WHOI, Proposal No. PO10849.00, August 10, 2001.